

ONLINE EXAMINATION PRACTICES IN HIGHER EDUCATION INSTITUTIONS: LEARNERS' PERSPECTIVES

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ABSTRACT

Online examinations, commonly known as electronic examinations (e-exams), are becoming increasingly implemented in higher education institutions in Palestine. However, learners' perspectives on these exams remain unexplored. This study therefore examines learners' perceptions of the online examination practices at Palestine Technical University-Kadoorie. An online questionnaire survey of 342 undergraduate students elicited their perceptions of the relative advantages of online examinations in terms of pedagogy, validity, reliability, affective factors, practicality and security. The results show that online exams were perceived to have significant benefits over traditional, paper-based examinations, including reliability of grading and efficiency in terms of time, effort and money spent on the exam process. Conversely, participants identified many challenges facing the successful implementation of online exams regarding security, validity and fairness issues. The findings also indicate that e-exams are particularly suitable for formative assessment, for measuring learning rather than the summative assessment of learning. The successful implementation of online exams depends on designing them to be valid, reliable, secure and flexible.

Keywords: Online examinations, e-exams, higher education, learners' perspectives, formative assessment.

INTRODUCTION

As a result of the advanced diffusion of information technology with the increasing availability of online assessment platform options, online examinations are being increasingly implemented in higher education institutions (HEIs) as a means of supplementing or even replacing paper-based tests (Nicol, 2007). Online examinations, commonly known as electronic examinations (e-exams) and previously as computer-based assessment, can be defined as "a system that involves the conduct of examinations through the web or the intranet" (Ayo et al., 2007, p. 126). Functionally, they can be delivered using a dedicated system or included as a module within a learning management system (LMS) such as Blackboard, Moodle or Sakai (Sorensen, 2013). The exam activity module allows the teacher to design and set exams consisting of a variety of question types including multiple choice, true-false and short answer questions. These are kept in a question bank and can be reused in multiple exams. Exams can be configured to allow multiple attempts. Each attempt is automatically marked and the teacher can choose whether to give feedback and/or show the correct answers (Moodle, 2017). Online examination systems, therefore, enable the simplification of the traditional paper-based examinations process especially when class sizes are large, from the designing and delivering the exam to marking, reporting, storing the results and conducting statistical analysis (Osuji, 2012; Farzin, 2016).

There is a body of research highlighting a number of key benefits of online examinations, as well as some notable challenges from the perspectives of both teachers and students (Nicol, 2007; Dermo, 2009; Cook & Jenkins, 2010; JISC, 2010; Dreher et al., 2011; Hodgson & Pang, 2012; James, 2016). Among their major

advantages over paper-based examinations are that they constitute a fully automated system which improves assessment validity, in which the examinee's performance is a fair measure of skill and understanding and which uses enhanced question styles incorporating interactivity and multimedia. Online examinations improve the reliability of scoring and the robustness of test results, supporting deeper analysis. They also provide immediate feedback, thus quickly correcting misconceptions. Compared to paper-based exams, the use of e-exams can significantly improve the efficiency of data management tasks such as marking, moderating and storing information, thus reducing the workload of teachers, who save time spent on routine work, while also significantly reducing the burden associated with invigilation when testing large student cohorts (JISC, 2010).

Although online examinations are increasingly being implemented by HEIs in Palestine, learners' perspectives on their use remain unexplored. Therefore, the main aim of this paper is to examine the online exam practices of HEIs from the perspective of learners who have experience of being examined online at Palestine Technical University-Kadoorie (PTUK). Its findings will help the university to identify important and strategic aspects of the effective design and setting of e-exams to support students' learning in a higher education setting.

LITERATURE REVIEW

A significant body of literature reports the perceptions of academic staff and learners concerning the relative advantages and challenges of online examinations and the need to implement them effectively (Bernik & Jereb 2006; Nicol, 2007; Dermo, 2009; Heinrich et al., 2009; Cook & Jenkins, 2010; JISC, 2010; Dreher et al., 2011; Hodgson & Pang, 2012; Kuikka et al., 2014; Baleni, 2015; Farzin, 2016; James, 2016).

The pedagogical advantage of online examinations most frequently cited in the literature is immediate feedback (Dermo, 2009; Heinrich et al., 2009; Dreher et al., 2011; Hodgson & Pang, 2012; Kuikka et al., 2014). For example, a survey of student perceptions carried out at the University of Bradford by Dermo (2009) showed that feedback enables new ways for students to learn. Dreher et al. (2011) also found that giving learners meaningful feedback on their progress, their strengths and elements requiring improvement empowered them to take the necessary action to improve their learning performance. Hodgson and Pang (2012) surveyed 104 students taking a statistics course at Hong Kong University and report that participants were very satisfied with the timely feedback provided when they answered multiple choice questions (MCQs). Such feedback has the potential to engage students in reflection and to take greater ownership of their learning, thus contributing to a change in their learning approach (Hodgson & Pang, 2012). A related benefit of online exams highlighted by many scholars is their practicality in terms of saving time, effort and cost (Dreher et al., 2011; Baleni, 2015). Their use helps to speed up testing by eliminating paper-based processes such as printing, while staff save the time and effort otherwise needed to grade hundreds of questions, leaving them more time to give meaningful feedback (Dreher et al., 2011).

Other benefits of online exams are reliability, validity and practicality. For educators it is very important for marking to be reliable, particularly for large classes (Heinrich et al., 2009). Dermo (2009) states that technological tools can be used to mark online exams more accurately than paper-based ones. Similarly, Baleni (2015) reports that first-year undergraduates at Eastern Cape University were positive about the accuracy of scoring exams on the Blackboard platform, because computers are free of human error and the technology used in online assessments is reliable. However, it must be acknowledged that such systems are feasible only for MCQs or short-answer questions (Farzin, 2016). In addition to accuracy of grading, learners are particularly interested in the transparency and fairness of their assessment (Iannone & Simpson, 2013). Online exams give them the confidence that the marking will be transparent because the results are generated instantly (Baleni, 2015; Farzin, 2016). Farzin (2016) identifies another benefit of online exams as reducing the possibility of cheating, in that the same questions can be presented to each student in a different order from that of their neighbours in the exam room. Alternatively, each examinee can be given a different set of questions chosen randomly from a question bank, but there are concerns as to the fairness of this procedure from the students' point of view, because some may have to answer more difficult questions than others (Dermo, 2009). Sorensen (2013) identifies a further problem with the randomisation of numerical questions. For instance, one particular combination of parameter values for a question ended

up with negative concentrations, which is not physically possible, despite being mathematically correct with the numerical values chosen. The ranges therefore had to be narrowed and all of the alternatives checked manually.

The validity of online exams is a critical issue. The incorporation of multimedia elements, including video or audio material, scenarios, internet links and simulations, is made possible by the use of online exams to measure students' knowledge of any given topic (Chua et al., 2013; Kuikka et al., 2014). Lim et al. (2006) used an online survey to examine the attitudes of medical students at the National University of Singapore regarding computer-based vs. paper-based testing. Four-fifths of participants preferred computer-based testing because it allowed the use of high quality images. Likewise, in a study of the use of MCQs on a statistics and mathematics course at the University of Beira Interior in Portugal, Ferrao (2010) found that the students were in favour of adopting e-exams more often, not only in statistics but also in other disciplines. Sorensen (2013) also studied student perceptions of e-assessment in the form of Moodle quizzes in a chemical engineering module. He found that students were in favour of e-assessment and would like to see it implemented in other departmental modules. Some researchers note that online exams are limited to closed-question formats such as MCQs, true-false, matching items and short answers, all of which tend to promote memorisation and factual recall and are unsuitable for the assessment of cognitive skills at the higher levels of Bloom's taxonomy, namely analytical, creative and constructive skills (Cook & Jenkins, 2010; Hodgson & Pang, 2012). Others, however, maintain that this depends on how the exams are constructed and that they can indeed be used to evaluate learning at higher cognitive levels (Simkin et al., 2005; Jordan, 2013; Williamson, 2018).

It has been argued that the main challenges facing e-exams are related to the time and skills required to construct high-quality objective assessment tools (Whitelock, 2006; Jamil et al., 2012; Kuikka et al., 2014). Jamil et al. (2012) elicited teachers' perceptions of computer-based vs. paper-based examinations in various universities in Pakistan. They found that the majority of teachers were highly concerned about the difficulty of creating different forms of objective questions for online exams, in the form of blank-filling, MCQs, matching items or short answers. Likewise, Kuikka et al. (2014) conducted a quantitative survey of teachers at Turku University of Applied Sciences in Finland to identify the challenges that they might face when introducing e-exams. They found resistance to change, whereby teachers were unwilling to change their examination habits, and conclude that good support and training would be helpful in overcoming this obstacle. This illustrates the need for management commitment to promote the use of e-exams and to provide guidance for teachers, not only technically but also pedagogically. The design of online exams must follow pedagogical principles, rather than merely embodying innovative technology, and the whole process must be carefully planned (Whitelock, 2006).

From the students' point of view, James (2016) found that first-year undergraduates at an Australian university were very familiar with the use of technology, but inexperienced in the online education environment and concerned about technical difficulties and internet connectivity. Similar findings are reported by Whitelock (2006), who warns that system failure during an online exam can discourage both teachers and students from using such systems. A test is viable only if students have enough confidence in it (Domino & Domino, 2006). Therefore, appropriate policies and plans that keep systems running effectively are essential and these clearly depend on organisational structures for their implementation and follow-up (Whitelock, 2006).

Several authors have also shed light on the need for security in online exams and have proposed various techniques for enhancing it (Al-Saleem & Ullah, 2014). For example, Anusha et al. (2012) raise the issue of exam candidates cheating by communicating with other students or by browsing the internet. The authors propose that webcams be used to monitor examinees and suggest the use of weblock software such as Secureexam Browser and Respondus LockDown Browser, whereby only the online exam material is displayed on the screen, while the browser and other applications are locked throughout the exam, thus disabling features such as screen capture, copy and paste, right-click menu options, browser menus, toolbar options and function keys. Another important security requirement is to authenticate the identity of test-takers. This can be accomplished by using various software and hardware tools such as webcams, fingerprint readers and biometric face recognition (Sarrayrih & Ilyas, 2013).

ONLINE EXAMINATION PRACTICES AT PTUK

A significant number of HEIs in Palestine have recently implemented online exams. Among these, PTUK has begun using e-exams for foundation courses on which a large number of students are registered, including Arabic Language, English Language, Computer Skills, Communication Skills, Islamic Studies and Palestinian Studies. Two mandatory online exams, the mid-term and summative final examinations, are taken during each semester, replacing paper-based assessment practices. The purpose of these exams is to evaluate students' achievement and to provide automatic grading.

Online exams are undertaken in fixed computer teaching labs on the PTUK campus. Such labs are normally restricted to 30 learners in a room, the number of labs is limited and the room layout is often not suitable for high-stakes exams. Furthermore, all exams are scheduled within a week, making it unlikely to be viable to use the labs for other courses. The online exams are included as a modular part of the Moodle platform. The questions are all MCQs, prepared by academics and sent to the e-exam committee, whose members are drawn from the Computer Department, to add them to question banks. The committee is responsible for designing, planning and administering the online exams. Invigilators are technicians of the computer labs and other part-time staff. To ensure security, students are required to show identity cards to the invigilators, then log into the exam within the Moodle platform using their university ID. During the exam, the students can review or change their answers by using the 'next' or 'back' buttons. Multiple attempts are not allowed. Access to the Internet is prohibited during the exams. Students receive no feedback on questions or overall results. Exams are marked via Moodle and the results forwarded to the committee, who export them to Excel files and send them to the instructors. Statistical analysis is performed by the instructors, many of whom are concerned only with how many students have passed or failed.

METHODOLOGY

The main aim of this paper is to examine the online exam practices in HEIs in Palestine from the perspective of learners who have experience of such exams at PTUK. The main research questions are:

- What are the perceptions of learners regarding the usefulness of online examinations in terms of pedagogy, validity, reliability, affective factors, practicality and security?
- What are the main challenges to the implementation of online examinations in HEIs in Palestine?
- What are the essential considerations needed for the successful implementation of online examinations in HEIs in Palestine?

The Student Perceptions of e-Assessment Questionnaire (Dermo, 2009) was used as the basis on which to develop an online questionnaire consisting of three main parts. In the first, participants were asked for general information. The second part asked them to respond to a number of statements concerning their opinions of online exams, all worded positively and grouped into six sets: pedagogy, validity, reliability, affective factors, practicality and security. The third part asked participants to select the important considerations needed for the successful implementation of online examinations. They were also asked to comment on the topics addressed by the questionnaire in a fourth section. The content validity of the questionnaire was assessed by asking three experts in e-learning and assessment to provide their judgments on the items. Positive feedback was received and some minor revisions were made to the instrument according to their suggestions. The reliability of the constructs (the extent to which the items in the questionnaire were related to each other) was examined using Cronbach's alpha. All values were above 0.70, which is good (Sekaran, 2003). The survey was conducted from 15 September 2017 to 30 January 2018. Participants were undergraduate students in four disciplines: Engineering, Agriculture, Economics and Science & Arts.

Participants' Profiles

There were 342 respondent students: 55.2% female and 44.8% male. The largest group was from the Engineering discipline (39.3% of respondents), followed by Science and Art (30.6%), Economics (16.4%) and Agriculture (13.7%). Almost half of respondents (44.5%) assessed themselves as having intermediate experience and 37.4% declared that they were experienced in IT skills. By contrast, 70% described themselves

as having no prior experience of online exams and a further 20% had taken only one online exam. This variation seems to reflect the reality on the ground; a majority of test takers were first-year students registered on foundation courses.

FINDINGS

Respondents reported mixed experiences of online examinations. Of the 18 questionnaire items, seven received positive mean responses, eight had clearly negative responses and three had neutral responses overall (Table 1). These ratings are based on a five-point adapted Likert scale, where the mid-point mean value of 3 can be seen as a neutral position, while a mean value above this can be seen to be positive and a mean rating below 3 is considered negative (Dermo, 2009).

For learners, the most advantageous aspect of online examinations was that marking was seen as more accurate than the traditional methods (mean = 4.2). Next, they were considered more efficient in terms of time, effort and money spent on the exam process (mean = 4.0). The strongest concerns for learners, reflected in negative responses, were the fairness of question banks (mean = 1.7) and whether the technology was sufficiently effective in dealing with cheating and plagiarism (mean = 1.6).

Table 1. Participants' responses on the relative advantages of online exams

Questionnaire items	SA	A	NS	DA	SDA	Mean
1. Pedagogy	%	%	%	%	%	
1.1. Immediate feedback in online exams helps learners to get a deeper understanding of the subject.	28	17	8	21	26	3.0
1.2. Using cutting-edge technology in online exams enables students to take a new learning approach - online learning.	16.2	58.4	6	9	10.4	3.6
1.3. Online exams facilitate a more adaptive learning approach than paper-based ones.	8	27	10	38	17	2.7
2. Validity						
2.1. Online exams are appropriate for any subject area.	6.2	7	10.8	28	48	2.0
2.2. Online exams are appropriate to test learners' level of knowledge.	2	4.5	13.5	29	52	1.8
2.3. Online exams facilitate more authentic assessment than traditional methods through integration of multimedia, simulations, etc.	25.6	40.4	14	13	7	3.6
3. Reliability						
3.1. Marking online exams automatically is more accurate than paper-based marking.	53	24	13.7	4.3	5	4.2
3.2. Online exams are fairer than paper-based exams.	1	3	17	21	58	1.7
3.3. The technology used in online exams is reliable.	17.5	7	5	24.8	45.7	2.3
4. Affective Factors						
4.1. Online examinations reduce stress and exam anxiety.	14	9	2.5	48	26.5	2.4
4.2. Using online exams allows learners to focus and concentrate more on the questions.	24	17.5	10.5	31	17	3.0
4.3. Learners feel more comfortable doing an online exam than a paper-based one.	17	43	5	19	16	3.3
5. Practicality						
5.1. Online exams are more efficient in terms of time, effort and money spent.	42.4	34.6	7	8	8	4.0
5.2. Creating a question bank of reusable MCQs, allows easy storage and review.	17	32	7	20	24	3.0
5.3. Online exams are more accessible than paper-based exams.	27	45	9.5	8.5	10	3.7
6. Security						
6.1. Test materials and results of online exams are more secure than traditional methods.	15.7	28.3	11	18	27	2.9
6.2. The technology used in online exams is sufficiently effective in dealing with cheating and plagiarism.	4	3	10	18	65	1.6
6.3. Using randomised questions from a bank means that cheating during online exams is less likely than for paper-based ones.	23	52	4	8	13	3.6

Note: SA: Strongly agree, A: Agree, NS: Not sure, DA: Disagree, SDA: Strongly disagree

The survey also listed several considerations that might improve the implementation of online exams. Participants were asked to select items from a checklist, as shown in Table 2. They were also invited to comment on the questionnaire in their native language in a text box, which 209 respondents (61% of the sample) did. These open comments were imported into an Excel file so that they could be analysed and triangulated with the quantitative analysis of the checklist data. The comments were coded according to their relation with the survey items, then organized into four groups: online exam design, online exam security, online exam purpose and institutional support (Table 2).

Table 2. Considerations for the effective implementations of e-exams

Considerations	Frequency	%
1. Online exam design		
1.1. Maintain a bank of validated questions for adaptive testing	280	81.9%
1.2. Develop different types of questions type	275	80.4%
1.3. Provide immediate meaningful feedback	288	84.2%
2. Online exam security		
2.1. Maintaining confidentiality	277	81.0%
2.2. Minimizing cheating	180	52.6%
2.3. Authentication	222	64.9%
3. Online exam purpose		
3.1. Formative exam for learning	240	70.2%
3.2. Linking online exams to ILOs	235	74.0%
3.3. Linking analysis of results to quality assurance criteria	228	66.7%
4. Institutional support		
4.1. Integrating the online exam within the strategic plan	231	67.5%
4.2. Providing resources and facilitating procedures	213	62.3%
4.3. Providing support for teachers and students	247	72.2%

DISCUSSION

Overall, participants seemed to consider the online examination practices currently implemented by PTUK unsatisfactory. Although they identified several positive features of online exams, including reliability of grading and efficiency in terms of time, effort and cost, they also noted many challenges facing the successful implementation of online exams in such areas as security, validity and fairness. Accordingly, the survey has identified a number of potential improvements to online exams at PTUK and more generally among Palestinian HEIs, from the perspective of learners.

Pedagogy

From a theoretical perspective, immediate feedback has been assumed to be fundamental pedagogical advantage of online exams, as reported by several studies (Bernik & Jereb 2006; Heinrich et al., 2009; Dreher et al., 2011; Hodgson & Pang, 2012; Kuikka et al., 2014). Table 1 shows that only 45% of respondents to this study agreed or strongly agreed that immediate feedback in online exams helps learners to gain a deeper understanding of the subject. The failure to recognise the usefulness of feedback may result from the fact that the online exam currently implemented at PTUK is exclusively summative and does not provide formative assessment, so learners receive no feedback. As immediate feedback can help to correct misconceptions and enhance students' learning (Miller, 2009; Dreher et al., 2011), it is indispensable to give learners immediate and meaningful feedback on both summative and formative assessments (Hodgson & Pang, 2012; Kuikka et al. 2014). Table 2 shows that 84.2% of participants recognized the importance of feedback as a crucial consideration that might improve the implementation of the online exam, this being the strongest response to an item in the third section of the questionnaire. More than two-thirds (70.2%) of

participants also considered online exams suitable for formative assessment to measure learning, rather than a summative assessment of learning. Thus, one purpose of the online exam should be to promote learning by the provision of constructive and real-time feedback. An online exam is not just an automated grading tool; it is also integral to the learning process itself (Jordan, 2013). Therefore, effective feedback should focus on helping learners to acquire a clear understanding of concepts and reinforce their knowledge. The challenge in providing relevant, timely and in-depth feedback to students lies in the considerable work that will be needed to train academic staff and support them in developing quality feedback, taking a more creative and efficient approach such as by using audio (McGarvey & Haxton, 2011) and video feedback in conjunction with written feedback.

Three-quarters of all participants agreed or strongly agreed that using cutting-edge technology in online exams enables students to take a new learning approach: e-learning. This is consistent with the findings of other research (Dermo, 2009). Tech-savvy students are likely to prefer digital learning that meets their needs. As e-exams are part of an online learning approach which has become mainstream for universities, academic staff must move away from their traditional classroom methods and embrace new methods of integrating emerging technologies in the teaching and learning environment, yet PTUK has been slow to fully embrace online learning. It takes time, effort and money to develop the infrastructure, skills, attitudes and policy to facilitate this approach. Institutional support is required to advance the sustainable development of the online learning approach. Approximately two-thirds of respondents to the questionnaire confirmed the importance of integrating the online assessment and online learning processes within the university's strategic plans.

An important feature of online exams is the adaptability of testing to meet the diverse needs of learners. Adaptive testing, where the next question to be posed is automatically adapted by the software according to each student's performance on earlier sections of the assessment, was viewed as problematic, however. Only 35% of participants thought that the online exam software facilitated a further advance in adaptive testing for students and addressed their diverse learning needs. The reason for the overall negative perception (mean = 2.7) may be that participants had not fully understood the concept of adaptive testing, since the tests with which they were familiar at PTUK were in the traditional format. Moodle and other software packages offer several online exam functionalities, but it seems that the examination committee and the staff were not aware of their pedagogical value. This illustrates the need to upgrade the version of Moodle consistently and to install all necessary plugins such as assignment feedback and Adaptive Quiz, which enables teachers to create tests that efficiently measure each test-taker's abilities (Moodle, 2017). In addition, to extend its functionalities, other exam software should be integrated into Moodle (or any LMS). Finally, to make the online exams more efficient, staff should be trained to develop adaptive test questions.

Validity

One of the most critical components of the assessment is exam validity. Table 1 shows that participants perceived online exams as invalid, in that they were not appropriate for many subjects (77%) and not well suited for assessing the higher-order thinking skills (81%). A common criticism of MCQs is that they test knowledge of facts but not understanding. A student who is unsure of the correct answer can simply guess, as one participant observed. This finding is similar to those of other researchers (Cook & Jenkins, 2010; Hodgson & Pang, 2012). It reflects the need for innovative ways to develop different question types that will accurately measure and support learners' level of knowledge. An online exam should go beyond multiple choice items, which should be used in combination with other types. Four-fifths of participants saw this as a critical consideration for the effective implementation of e-exams. Online exams, especially for language courses, should include items where students listen to audio material, then answer questions on it, and others where they are required to give spoken responses which are video-recorded. Other question types which should also be included are short essays and written assignments that demonstrate learners' comprehension of the material and critical thinking. A major difficulty in designing online exams is to create non-objective questions to measure students' in-depth understanding (Cook & Jenkins, 2010). Considerable work is required to prepare staff not only technically but also pedagogically to better design MCQs and other types of questions that will actually assess the intended learning outcomes (ILOs) of the course, including higher order learning (Kuikka et al., 2014). Nearly three-quarters of respondents (74%) believed that questions should be aligned with teaching and learning activities and with the ILOs.

Table 1 also shows that two-thirds of participants (66%) agreed or strongly agreed that online exams facilitate more authentic assessment than traditional methods through the integration of multimedia and simulations. Similar results are reported by Chua et al. (2013) and Kuikka et al. (2014), who conclude that new technologies allow examinees to be exposed to video, audio or simulations before answering different types of questions related to the multimedia, thus making online exams more engaging than traditional methods. Learners value the harnessing of technology to transform assessment practices and to ensure that assessment is valid and authentic, by means of strategies such as simulation, problem-based approaches, portfolios of evidence and the integration of online and face-to-face assessment (JISC, 2010). Table 2 shows that two-thirds of respondents recognised the importance quality in online exams by agreeing that the analysis of results should be linked to quality assurance criteria.

Reliability

Reliability is an important issue in any exam. When participants were asked whether they thought that the use of online examinations enhanced the accuracy of results, more than three-quarters agreed that automatic marking is more accurate than paper-based marking. One participant commented that e-exams are fair and have “no bias in grading”. This is consistent with the findings of Baleni (2015), who also found that transparent marking and immediate delivery of grades give learners more confidence in the results than in those of traditional tests. Nevertheless, many participants were concerned with the accuracy of results due to errors in questions and responses. One commented that “errors are found in questions and responses ... Incorrect questions can't be changed during the exam and we are forced into wrong answers”. Any ambiguity in questions will invalidate the test. Therefore, each question should be reviewed by subject-matter experts and academic staff should take full responsibility for the assessment process. This is reflected in the first item in Table 2: four-fifths of respondents considered that the successful implementation of online exams required the maintenance of banks of validated questions.

While most considered e-exam results more accurate, an even greater proportion (79%) of participants disagreed that online exams are fairer than paper-based ones. They believed that randomising the questions from a question bank would mean that some students could be asked relatively easy questions and others more difficult ones. This finding is in line with other studies (Dermo, 2009; Farzen, 2016). Thus, to ensure that online exam questions appropriately assess the same ILOs for all students and are of equivalent difficulty (Jordan, 2013), it is necessary to consider adaptive testing, where different questions types are selected from a question bank and algorithmic tools are used to assign them to levels of difficulty (Gershon, 2005).

Other important requirements for the successful implementation of online exams are reliable and affordable bandwidth and a robust network. Item 3.3 in Table 1 reveals that 70.5% of participants were concerned that the technology used in online exams was unreliable. The existing IT infrastructure at PTUK may not be robust enough to cope with the increasing number of learners taking online exams. Exams are subject to interruption due to slow computers, slow loading, poor network connectivity or breaks in the power supply. When one of these technical problems occurs, the examinations have to be rescheduled, which is inconvenient and stressful for students. Universities should improve their infrastructure and provide fully equipped labs with adequate security resources (Osuji, 2012). Almost two-thirds of participants indicated that the successful implementation of e-exams depends on institutional support, including the creation of suitable conditions for taking exams, the facilitation of administrative procedures and the provision of the financial resources necessary for infrastructure improvement.

Affective Factors

Another important area of concern was the affective aspects of online exams. Three-quarters of participants disagreed with the assertion that online exams reduce stress and anxiety. This result is in line with the work of Bernik and Jereb (2006) and Whitelock (2006). Participants mentioned in their comments several reasons for their stress, including the interruption of exams because of technical problems, their unfamiliarity with the use of Moodle for online exams, their lack of IT skills and the poor wording of questions. One participant complained that students were given insufficient instructions at the beginning of exams, a

problem exacerbated by the fact that Moodle “is in English, not in our native language”. As the majority of participants (70%) were first-time online test-takers, they lacked familiarity with the online exam platform and a clear understanding of its practices (James, 2016). Thus, it is important for institutions to pay more attention to training both academic staff and students in the online exam process before they actually engage in it (Osuji, 2012; Jordan, 2013). Table 2 shows that 72.2% of participants considered support for teachers and students to be important for the effective implementation of online exams. The few minutes of guidance given to students before the exam was inadequate to provide sufficiently clear instructions. Academic staff need time and specialist skills to prepare quality questions, to provide feedback and to manage exams in digital formats.

A clear majority (60%) of participants agreed, in line with the findings of Bernik and Jereb (2006), that learners feel more comfortable doing an online exam than a paper-based one (Table 1, item 4.3), perhaps because this format significantly reduces the need for invigilation of the exam. By contrast, responses were neutral overall to the suggestion that the online format allows learners to focus better on the questions. A reason given by one participant for disagreeing with this was that it could be difficult to concentrate on the screen because of the need to use paper to solve specific problems, especially those requiring a calculation or algebraic manipulation. He also noted that because marks are given only for choosing the correct option, a student who chose the wrong one could not be rewarded for following the correct method.

Practicality

The results also show that 77% of respondents agreed that online exams are more efficient than paper ones in terms of time, effort and cost. The fully automated process can eliminate or simplify printing, grading, analysis of the results, invigilation and staff workload, especially for large class size. This finding is aligned with those of several studies (Dermo, 2009; Dreher et al., 2011; Baleni, 2015). However, in order to make use of online technology to reduce staff workload, it is first necessary to migrate from a paper-based to a digital approach to pedagogy and learning, which is a time-consuming and costly process, especially at the early stage of implementation (Jamil et al., 2012; Kuikka et al., 2014).

Arguably, another time-saving advantage of online exams lies in the creation of banks of reusable MCQs, easily stored and reviewed for use with subsequent cohorts, although respondents were almost equally divided between agreeing and disagreeing with this assertion (mean = 3). Test items must be regularly renewed to reduce the risk of cheating and memorisation. Online exam questions should also be subject to quality assurance standards by ensuring that question design is appropriately aligned with course learning objectives. For example, devising MCQs and feedback is time consuming for staff and will require technical and pedagogical skills and support.

Although the only online exams currently conducted at PTUK are summative tests held in computer labs on campus, 72% of participants perceived online exams to be more accessible than paper-based ones. Formative testing should be performed on a regular basis. Online tests can be delivered at any time and place, including during lectures, and can be combined with bite-sized chunks of relevant learning by exploiting students’ mobile devices (Shraim & Crompton, 2015). A relevant factor is the recent significant development and expansion of online and distance education. The educational landscape in Palestine is undergoing a transformation whereby universities are at different stages of the adoption of online learning and online examinations (Shraim, 2018). If more universities are to adopt this approach, careful consideration must be given to flexibility in delivering online exams, to improving the infrastructure and to addressing security issues.

Security

Security is a critical aspect of any exam. Table 1 shows that participants were more or less evenly divided as to whether test materials and results are more secure when exams are held on line rather than by traditional methods. This finding is consistent with those of Bernik and Jereb (2006) and Dermo (2009). Exam management systems such as Moodle incorporate monitoring functions to protect data from unauthorised access by systematically tracking and recording activities such as login, logout, exam access, question navigation and responses. The content of each exam is safely locked away in a database on a server accessible

only to authorized personnel. As revealed in Table 2, 81% of participants considered it extremely important to maintain the confidentiality and network security of online examinations so as to prevent misuse of question banks and other data, which should be stored in a highly secure encrypted form.

Moreover, the most strongly negative response (mean = 1.6) was to the assertion that the technology of online exams is sufficiently effective in dealing with cheating and plagiarism, with which as many as 83% of participants disagreed and only 7% agreed. Preventing cheating during online exams can be difficult, given the availability of technologies such as Bluetooth, wireless networking, mobile phones and wearable technology. These provide several ways for learners to search the Internet and to communicate with others during exams and are not easily blocked. Besides, with large groups of students taking exams at different times, one group may advantage another by passing on information about the test. Thus, cheating may be hard to prevent, especially as tech-savvy students will always find innovative ways to cheat. Although PTUK has recently enacted regulations against mobile phone use, requiring students to turn them off during exams, several participants mentioned unethical behaviour in their comments. One wrote that “it is easier to cheat in an online exam ... I often use my smart watch to send a screen shot to the whole group”. Another commented: “I use my mobile phone to text and chat with friends.” Thus, it is challenging to find ways of minimising cheating. More than half (52.6%) of participants referred to the necessity to combine different techniques and to stay up to date with innovative security software solutions. The Secureexam browser, for example, prevents learners from opening any other window during an online examination and disables right-click options including copying, pasting and screen capture (Anusha et al., 2012; Sarrayih & Ilyas, 2013).

Authentication of examinees is another important aspect of security, as identified by almost two-thirds of participants (Table 2, item 2.3). The mere requirement to input a user name and password is not adequate for this purpose. Detection technologies such as webcams, biometric keystroke analysis and other sophisticated software are available to support invigilation and authentication, allowing the system to verify students' identities and validate their achievements. However, authentication of identity and monitoring are more difficult in the case of distance online exams, because unlike the traditional setting of a classroom in the physical presence of a human invigilator, remote students typically take exams in uncontrolled environments such as homes or public places. Therefore, to demonstrate and maintain integrity, universities require real-time invigilation. Remote proctoring software enables students to sit exams in any location they choose by monitoring their mouse manipulation and their head and eye movements in order to detect cheating attempts.

Although Moodle does not have fully effective features for dealing with cheating and plagiarism, it does provide a wide range of options to randomise the order of MCQs and to shuffle the answers, thus minimising unethical behaviour. Table 1 shows that 75% of participants agreed that randomised questions from a bank made cheating less likely during online exams than paper-based ones, which is consistent with the findings of Bernik and Jereb (2006).

CONCLUSION

With the widespread and increasing use of online examinations at higher education institutions in Palestine, this study has examined the practicalities of such examinations and identified several factors to be considered to support the successful implementation of e-exams from the perspective of PTUK students.

Participants perceived online exams as having significant advantages over traditional, paper-based ones, including reliability of scoring and long-term efficiency in terms of time, effort and costs. The findings also indicate that fairness, validity and security aspects are the main challenges facing the successful implementation of online exams.

Thus, the effectiveness of online exams can be achieved by designing them to be valid, reliable, secure and flexible, with the purpose of promoting learning and ensuring alignment with ILOs. Successful implementation requires institutional support, including the creation of suitable conditions for conducting online examinations, facilitating administrative procedures, providing the necessary financial support, improving infrastructure, building the capacity of academic staff and providing them with guidance and with technical and pedagogical support. This study has shown that in the interests of sustainable development, the online exam approach should be embedded within the university's strategic planning.

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